

BASIS FOR REDUCING THE LATERAL SHIELDING  
IN THE B & C TARGET AREAS

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(This is an effort to provide the source of data and assumptions being used in the discussion of A. Maschke, L. Read, and others which lead to a reduction in the lateral shielding of the external target areas)

The main basis for a change is experience at other accelerators and preliminary report of shielding experiments at CERN. (Study UCID-10199, 4-28-67) reported by R. D. Fortune, W. S. Gilbert and R. H. Thomas.

Their preliminary conclusion is Table III on page 15.

For a 200 BeV accelerator with 13% targeting of a  $5 \times 10^{13}$  proton/sec they give that one needs 1600-1700 gms/cm<sup>2</sup> where as the earlier figure was 2350 gms/cm<sup>2</sup>. The above shielding leads to 110 m rem/hr outside the shield. To correct this figure to about 5 m rem/hr with a  $1 \times 10^{13}$  protons/sec hitting a thick target followed by magnets (or effectively a stop) one needs an additional attenuation factor of 30.

The same report of Fortune et al. gives an attenuation length of 98 g/cm<sup>2</sup> in a plane arrangement and 107 g/cm<sup>2</sup> in a cylindrical arrangement. The old rule of thumb is 250 g/cm<sup>2</sup> (also report of Ranft ECFA vol. II, Fig. 5, pg. 323)

gives  $108 \text{ g/cm}^2$ . (Recent measurements of 3.5 BeV/c Pions at the ZGS gives  $\lambda = 135 \text{ g/cm}^2$ . In aluminum, therefore, the value of  $108 \text{ g/cm}^2$  for neutrons is understandable in terms of fundamental cross-sections). Therefore  $250 \text{ g/cm}^2$  for a factor of 10 remains the value to use in making corrections for heavy concrete and steel.

An additional factor of 30 requires  $360 \text{ g/cm}^2$ . Therefore the  $1600\text{-}1700 \text{ g/cm}^2$  of the Fortune et al. becomes  $1960\text{-}2060 \text{ g/cm}^2$ .

Using a density of 3.5 for heavy concrete, one gets that the lateral shielding should be

$$\frac{1960}{3.5} \times \frac{1}{30} = 19 \text{ feet}$$

$$\frac{2060}{3.5} \times \frac{1}{30} = 20 \text{ feet.}$$

This figure is for 5 m rem/hr and  $1 \times 10^{13}$  proton/sec.

The previous figure was about 28 feet of heavy concrete or 14 feet of iron. These were based (in my estimates) on a report by Ranft (ECFA vol II); table on p. 115, where the column  $10^{14}$  really corresponded to  $10^{13}$  (see page 318) and 1 m rem/hr. The table gave 415 cm of iron which is 14 feet.